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C-A OPERATIONS PROCEDURES MANUAL

7.1.72 Blue Ring Cooldown, 80K to 4.5K

Text Pages 2 through 6

Hand Processed Changes

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Approved: \_\_\_\_\_ *Signature on File* \_\_\_\_\_  
Collider-Accelerator Department Chairman Date

C. Salat

## **7.1.72 Blue Ring Cooldown, 80K to 4.5K**

### **1. Purpose**

This procedure describes cooling the Blue ring to 4.5 K while maintaining the Yellow ring “M” line on 80K maintenance loop.

### **2. Responsibilities**

- 2.1 The Shift Supervisor, or an Operator designated by the Shift Supervisor, is responsible for conducting the procedure and providing documentation in the Cryogenic Control Room Log.
- 2.2 Should a problem arise during the completion of this procedure, the Shift Supervisor shall contact the Technical Supervisor for instructions before continuing.

### **3. Prerequisites**

- 3.1 The Shift Supervisor/Operator shall be familiar with the following drawings:
  - 3A995005 25 KW refrigerator P&ID.
  - 3A995108 RHIC 80K cooler integration diagram
  - 3A995121 RHIC 80K cooling system P&ID
  - 3A995006 Ring block diagram
  - 3A995073 LSA liquid storage P&ID
  - Refrigerator valve reference guide
- 3.2 The Shift Supervisor/Operator shall be familiar with the physical location of components on the drawings listed under 3.1.
- 3.3 The Shift Supervisor/Operator shall be familiar with the CRISP and Indusoft computer control systems.
- 3.4 Completion of [C-A OPM 7.1.11](#), “25KW Helium Refrigerator Cooldown”, and phase 3 of [C-A OPM 7.1.25](#), “Liquid Storage Cooldown and Fill Procedure”.

### **4. Precautions**

- 4.1 Confirm the availability of Particle Accelerator Safety System (PASS) in the refrigeration wing of 1005R.
- 4.2 All personnel entering the refrigeration wing of 1005R must have a personal ODH monitor and carry an emergency escape pack, if there is liquid helium in the pots.
- 4.3 All personnel entering Bldg. 1005H must wear double hearing protection.

## 5. Procedure

- \_\_\_\_\_ 5.1 Isolate blue ring “M” line from the 80 K maintenance loop. Prior to valve manipulation, log yellow ring “M” line 80K maintenance loop flow rate. At 80K cooler, close valves H9359A and H9360A. Put manual handwheel to the closed position.
- \_\_\_\_\_ 5.2 Adjust 80K cooler yellow “M” line flow rate to previously logged value by slowing circulators.
- \_\_\_\_\_ 5.3 Slowly drain blue “M” line pressure down to 3 atm. At refrigerator, ensure open H849A and H9935M. At 8 BVB, ensure closed H4803A. At 6BVB, cycle open & closed H4637A and utilize H4606A to control “M” line pressure reduction. Once pressure is at 3 atm., put H4606A in auto with setpoint of 3 atm.
- \_\_\_\_\_ 5.4 Line up CR path from 6:00 BVB to first refrigerator bypass. Close/ensure closed H4644A, H4643A, H4659M, and H9933M. Open/ensure open H849A, H9935M, H5M, H827M. Slowly open H425M.
- \_\_\_\_\_ 5.5 Line up for 4.5 K “M” line flow. Put H206A in auto with a setpoint of 6 atm.

**Note:**

Ensure EX7 logic is in override mode.

- \_\_\_\_\_ 5.6 Initiate flow through Blue ring “M” line at 6:00 BVB.  
At 6:00 BVB: open H6733M and H4500A. Slowly open H4524A.  
At LSA: close S to R bypass loop valve H9703A. Close H4505A.  
At refrigerator: Close H131A  
(adjust cold turbines as necessary)

**Note:**

If liquid helium is going to be added to the system at CB5 through H122A, refer to [C-A-OPM 7.1.25](#), Section 5.1, and skip to step 5.13 of this procedure.

- \_\_\_\_\_ 5.7 Use Liquid from LSA to aid refrigeration. Select a LHe dewar and pressurize to .75 atm above return pressure PI4841 using supply pressure valve H4526A and Dewar J-T valve.
- \_\_\_\_\_ 5.8 Close H4526A and J-T valve. Open dewar liquid feedline. (i.e. H9742A–dewar #1)

- \_\_\_\_\_ 5.9     Begin initializing liquid flow through refrigerator return;  
                   At LSA, open H4505A.  
                   At refrigerator, open/ensure open H238M. Open H26A.  
                   At 6:00 BVB, open H4608A.
- \_\_\_\_\_ 5.10    The goal here is to flow the mixture of ring return and liquid into the cold end of  
                   the refrigerator return and place it on the first refrigerator bypass. This will free  
                   up the CR line for use later in this procedure.
- \_\_\_\_\_ 5.11    Slowly start to open H123A to approximately 15-20%. This will send return to  
                   the first refrigerator bypass. Monitor TI342 (bypass return temp). Keep this  
                   temperature stable by adjusting H123A.
- \_\_\_\_\_ 5.12    Once TI342 is stable and TI228 (upstream of H123A) is equal to TI342, close  
                   H4537A (6:00 BVB), open H123A to 100%, and close H5M. Ring return is now  
                   entering refrigerator through cold end return.
- \_\_\_\_\_ 5.13    When the 4 K wave hits the 12:00 VB, begin cooling the S and R lines and  
                   recoolers. Start with the recoolers returning to the CR line, as it should now be  
                   available again. Watch the temperature at the refrigerator TI105 in CR line to  
                   determine where to return the gas. Remember if the cold end return temperature  
                   is different you may separate the two streams with H5M or H26A. Most likely to  
                   start, the CR will enter through H425M/H825M bypass, but may get warm  
                   enough to need redirection through H4643A.

To begin, configure the R-line and U-line piping for connection to the VJRR CR  
 as follows: (The utility line at the left (toward 8:00) of 6:00 B is in use so it can  
 not be used between 6:00 and 4:00)

Open: H4536A, H4636A, H4637A.

Open all blue R-line series valves at 4:00, 2:00, 12:00, 10:00, 8:00

Open blue U-line series valves at 4:00, 2:00, 12:00, 10:00, (Not 8:00)

Open blue U to R cross-connects at 4:00, 2:00, 12:00, 10:00, (Not 8:00)

- \_\_\_\_\_ 5.14    Check all blue recooler valves are in manual and closed.
- \_\_\_\_\_ 5.15    Check closed blue S-M and S-U cross-connects around ring.
- \_\_\_\_\_ 5.16    Open all blue S-line series valves around ring.
- At 6:00 blue, open H4601A, H4501A, H4614M, H4534M.
- \_\_\_\_\_ 5.17    Begin opening recooler JT valves with attention to the refrigerator cold end. This  
                   will be a major load increase and you may need to reduce the cold end flow by  
                   adjusting H206A.

As a starting point, set all JT open limits to 5% and switch to auto with levels set

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**Note:**

When valve box and sextant recooler outlet temperatures are under 5K,  
 enable level probe power located on each VB control page. Once 4.5K  
 wave passes through each lead pot, set mass flow controllers in auto  
 (D205-D215).

01  
07

at 50%. Balance the turbines with 250 g/s through H206A, 1300 g/s through turbines 5 and 6 and 700 g/s through turbines 1,2,3,4.

The object here is to get the S and R lines, and the recoolers cold near the time the 4 K wave gets to 6:00, so balance recooler flow and magnet flow accordingly to accomplish. (Cold magnets with recoolers not ready is NG)

**Note**

As the recoolers get colder, be ready to make the proper bypass adjustments at the refrigerator. **When the recoolers' return to CR, and the M-line return flow to the R-line are at the same temperature at the 6:00 VB proceed as follows: Open H4504A, H4604A, and H4508A. Close H4536A and H4636.**

- \_\_\_\_\_ 5.18 When the 4 K wave reaches 8:00, begin cooling the 6:00 blue lead pot:
  - Check closed H6823M
  - Open H4642A (override on page 247, click "blue circ. Offline to green)
  - Crack open H4533A, approx. 1%. Watch CR temp TI4610 and adjust 4533A accordingly
- \_\_\_\_\_ 5.19 When the 4 K wave gets around the ring and back to the refrigerator, bypass valves at the refrigerator return header will need manipulation to take advantage of the sensible heat. Direct the return flow through H157M, then H409A (or H809A for cold "B" turbines), then H33A as the temperature becomes appropriate (don't be premature here). Perform the last two bypass changes with caution so not to upset the cold end of the machine. Slowly open the valves while watching the appropriate temperature sensor(s). When bypass valves have been successfully switched the turbines will need attention.
- \_\_\_\_\_ 5.20 Send personnel into ring to open blue thermistor isolation valves.
- \_\_\_\_\_ 5.21 On each sextant control screen, open all automatic thermistor outlet valves to warm return. Enable thermistor power.
- \_\_\_\_\_ 5.22 On control screen D177, open all 7 automatic warm return valves. On screen D31, open H4658A.

**Transition to M – S – recooler supply mode (prerequisite: recoolers full)**

- \_\_\_\_\_ 5.23 Verify H4601A closed.
- \_\_\_\_\_ 5.24 Put H4501A in auto with setpoint equal to the current m-line pressure PI3716
- \_\_\_\_\_ 5.25 When S-line pressure PI3719 equals M-line pressure PI3716, Open \_\_\_\_\_  
H4630A
- \_\_\_\_\_ 5.26 Close H4533A
- \_\_\_\_\_ 5.27 Close H4606A

- \_\_\_\_\_ 5.28 Place H4501A in auto
- \_\_\_\_\_ 5.29 Open H4524A to 100% in manual

## **6. Documentation**

- 6.1 The check-off lines on the procedure are for place-keeping only. The procedure is not to be initialed or signed, it is not a record.
- 6.2 The Shift Supervisor shall document the completion of the procedure in the Cryogenics Control Room Log

## **7. References**

- 7.1 Drawing 3A995009, 25°kW Helium Refrigerator P&ID.
- 7.2 Drawing 3A995066, 6:00 Yellow Ring P&ID.
- 7.3 Drawing 3A995086, 6:00 Blue Ring P&ID.
- 7.4 Refrigerator Valve Reference Guide.

## **8. Attachments**

None